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Neck Pain:

Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health From the Orthopaedic Section of the American Physical Therapy Association

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Recommendations*

PATHOANATOMICAL FEATURES: Although the cause of neck pain may be associated with degenerative processes or pathology identified during diagnostic imaging, the tissue that is causing a patient's neck pain is most often unknown. Thus, clinicians should assess for impaired function of muscle, connective, and nerve tissues associated with the identified pathological tissues when a patient presents with neck pain. (Recommendation based on theoretical/foundational evidence.)

RISK FACTORS: Clinicians should consider age greater than 40, coexisting low back pain, a long history of neck pain, cycling as a regular activity, loss of strength in the hands, worrisome attitude, poor quality of life, and less vitality as predisposing factors for the development of chronic neck pain. (Recommendation based on moderate evidence.)

DIAGNOSIS/CLASSIFICATION: Neck pain, without symptoms or signs of serious medical or psychological conditions, associated with (1) motion limitations in the cervical and upper thoracic regions, (2) headaches, and (3) referred or radiating pain into an upper extremity are useful clinical findings for classifying a patient with neck pain into one of the following International Statistical Classification of Diseases and Related Health Problems (ICD) categories: cervicalgia, pain in thoracic spine, headaches, cervicocranial syndrome, sprain and strain of cervical spine, spondylosis with radiculopathy, and cervical disc disorder with radiculopathy; and the associated International Classification of Functioning, Disability, and Health (ICF) impairment-based category of neck pain with the following impairments of body function:

- Neck pain with mobility deficits (b7101 Mobility of several joints)
- Neck pain with headaches (28010 Pain in head and neck)
- Neck pain with movement coordination impairments (b7601 Control of complex voluntary movements)
- Neck pain with radiating pain (b2804 Radiating pain in a segment or region)

The following physical examination measures may be useful in classifying a patient in the ICF impairment-based category of neck pain with mobility deficits and the associated ICD categories of cervicalgia or pain in thoracic spine. (Recommendation based on moderate evidence.)

- Cervical active range of motion
- Cervical and thoracic segmental mobility

The following physical examination measures may be useful in classifying a patient in the ICF impairment-based category of neck pain with headaches and the associated ICD categories of headaches or cervicocranial syndrome. (Recommendation based on moderate evidence.)

- Cervical active range of motion
- Cervical segmental mobility
- Cranial cervical flexion test

The following physical examination measures may be useful in classifying a patient in the ICF impairment-based category of neck pain with movement coordination impairments and the associated ICD category of sprain and strain of cervical spine. (Recommendation based on moderate evidence.)

- Cranial cervical flexion test
- Deep neck flexor endurance test

The following physical examination measures may be useful in classifying a patient in the ICF impairment-based category of neck pain with radiating pain and the associated ICD categories of spondylosis with radiculopathy or cervical disc disorder with radiculopathy. (Recommendation based on moderate evidence.)

- Upper limb tension test
- Spurling's test
- Distraction test

DIFFERENTIAL DIAGNOSIS: Clinicians should consider diagnostic classifications associated with serious pathological conditions or psychosocial factors when the patient's reported activity limitations or impairments of body function and structure are not consistent with those presented in the diagnosis/classification section of this guideline, or, when the patient's symptoms are not resolving with interventions aimed at normalization of the patient's impairments of body function. (Recommendation based on moderate evidence.)

EXAMINATION – OUTCOME MEASURES: Clinicians should use validated self-report questionnaires, such as the Neck Disability Index and the Patient-Specific Functional Scale for patients with neck pain. These tools are useful for identifying a patient's baseline status relative to pain, function, and disability and for monitoring a change in a patient's status throughout the course of treatment. (Recommendation based on strong evidence.)

EXAMINATION – ACTIVITY LIMITATION AND PARTICIPATION RESTRICTION MEASURES: Clinicians should utilize easily reproducible activity limitation and participation restriction measures associated with their patient's neck pain to assess the changes in the patient's level of function over the episode of care. (Recommendation based on expert opinion.)

INTERVENTIONS – CERVICAL MOBILIZATION/MANIPULATION: Clinicians should consider utilizing cervical manipulation and mobilization procedures, thrust and non-thrust, to reduce neck pain and headache. Combining cervical manipulation and mobilization with exercise is more effective for reducing neck pain, headache, and disability than manipulation and mobilization alone. (Recommendation based on strong evidence.)

INTERVENTIONS – THORACIC MOBILIZATION/MANIPULATION: Thoracic spine thrust manipulation can be used for patients with primary complaints of neck pain. Thoracic spine thrust manipulation can also be used for reducing pain and disability in patients with neck and neck-related arm pain. (Recommendation based on weak evidence.)

Recommendations* *(continued)*

INTERVENTIONS – STRETCHING EXERCISES: Flexibility exercises can be used for patients with neck symptoms. Examination and targeted flexibility exercises for the following muscles are suggested: anterior/medial/posterior scalenes, upper trapezius, levator scapulae, pectoralis minor, and pectoralis major. (Recommendation based on weak evidence.)

INTERVENTIONS – COORDINATION, STRENGTHENING, AND ENDURANCE EXERCISES: Clinicians should consider the use of coordination, strengthening, and endurance exercises to reduce neck pain and headache. (Recommendation based on strong evidence.)

INTERVENTIONS – CENTRALIZATION PROCEDURES AND EXERCISES: Specific repeated movements or procedures to promote centralization are not more beneficial in reducing disability when compared to other forms of interventions. (Recommendation based on weak evidence.)

INTERVENTIONS – UPPER QUARTER AND NERVE MOBILIZATION PROCEDURES: Clinicians should consider the use of upper quarter and nerve mobilization procedures to reduce pain and disability in patients with neck and arm pain. (Recommendation based on moderate evidence.)

INTERVENTIONS – TRACTION: Clinicians should consider the use of mechanical intermittent cervical traction, combined with other interventions such as manual therapy and strengthening exercises, for reducing pain and disability in patients with neck and neck-related arm pain. (Recommendation based on moderate evidence.)

INTERVENTIONS – PATIENT EDUCATION AND COUNSELING: To improve recovery in patients with whiplash-associated disorder, clinicians should (1) educate the patient that early return to normal, non-provocative pre-accident activities is important, and (2) provide reassurance to the patient that good prognosis and full recovery commonly occurs. (Recommendation based on strong evidence.)

*These recommendations and clinical practice guidelines are based on the scientific literature published prior to June 2007.

Introduction

AIM OF THE GUIDELINE

The Orthopaedic Section of the American Physical Therapy Association (APTA) has an ongoing effort to create evidence-based practice guidelines for orthopaedic physical therapy management of patients with musculoskeletal impairments described in the World Health Organization's International Classification of Functioning, Disability, and Health (ICF).[86]

The purposes of these clinical guidelines are to:

Describe evidence-based physical therapy practice including diagnosis, prognosis, intervention, and assessment of outcome for musculoskeletal disorders commonly managed by orthopaedic physical therapists

- Classify and define common musculoskeletal conditions using the World Health Organization's terminology related to impairments of body function and body structure, activity limitations, and participation restrictions
- Identify interventions supported by current best evidence to address impairments of body function and structure, activity limitations, and participation restrictions associated with common musculoskeletal conditions
- Identify appropriate outcome measures to assess changes resulting from physical therapy interventions in body function and structure as well as in activity and participation of the individual
- Provide a description to policy makers, using internationally accepted terminology, of the practice of orthopaedic physical therapists
- Provide information for payers and claims reviewers regarding the practice of orthopaedic physical therapy for common musculoskeletal conditions
- Create a reference publication for orthopaedic physical therapy clinicians, academic instructors, clinical instructors, students, interns, residents, and fellows regarding the best current practice of orthopaedic physical therapy

STATEMENT OF INTENT

This guideline is not intended to be construed or to serve as a standard of medical care. Standards of care are determined on the basis of all clinical data available for an individual patient and are subject to change as scientific knowledge and technology advance and patterns of care evolve. These parameters of practice should be considered guidelines only. Adherence to them will not ensure a successful outcome in every patient, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgment regarding a particular clinical procedure or treatment plan must be made in light of the clinical data presented by the patient, the diagnostic and treatment options available, and the patient's values, expectations, and preferences. However, we suggest that significant departures from accepted guidelines should be documented in the patient's medical records at the time the relevant clinical decision is made.

Methods

Content experts were appointed by the Orthopaedic Section, APTA as developers and authors of clinical practice guidelines for musculoskeletal conditions of the cervical region that are commonly treated by physical therapists. These content experts were given the task to identify impairments of body function and structure, activity limitations, and participation restrictions, described using ICF terminology, that could (1) categorize patients into mutually exclusive impairment patterns upon which to base intervention strategies, and (2) serve as measures of changes in function over the course of an episode of care. The second task given to the content experts was to describe interventions and supporting evidence for specific subsets of patients based upon the previously chosen patient categories. It was also acknowledged by the Orthopaedic Section, APTA content experts that a systematic search and review of the evidence solely related to diagnostic categories based on International Statistical Classification of Diseases and Health Related Problems (ICD)[87] terminology would not be useful for these ICF-based clinical practice guidelines as most of the evidence associated with changes in levels of impairment or function in homogeneous populations is not readily searchable using the ICD terminology. Thus, the authors of this clinical practice guideline systematically searched MEDLINE, CINAHL, and the Cochrane Database of Systematic Reviews (1966 through June 2007) for any relevant articles related to classification, outcome measures, and intervention strategies for musculoskeletal conditions of the neck region commonly treated by physical therapists. Each content expert was assigned a specific subcategory (classification, outcome measures, and intervention strategies for musculoskeletal conditions of the neck region) to search by the lead author (JDC) based upon their specific area of expertise. Two content experts were assigned to each subcategory and both individuals performed a separate search, including but not limited to the 3 databases listed above, to identify articles to assure that no studies of relevance were omitted. Additionally, when relevant articles were identified, their reference lists were hand-searched in an attempt to identify other articles that might have contributed to the outcome of these clinical practice guidelines.

This guideline was issued in 2008 based upon publications in the scientific literature prior to June 2007. This guideline will be considered for review in 2012, or sooner if substantive new evidence becomes available. Any updates to the guideline in the interim period will be noted on the Orthopaedic Section of the APTA website: www.orthopt.org

LEVELS OF EVIDENCE

Once the content experts of each subcategory had identified all relevant articles, they independently graded each article according to criteria described by the Center for Evidence-Based Medicine, Oxford, United Kingdom (Table 1 below). If the 2 content experts did not agree on a grade of evidence for a particular article, a third content expert was used to resolve the issue.

I	Evidence obtained from high-quality randomized controlled trials, prospective studies, or diagnostic studies
II	Evidence obtained from lesser-quality randomized controlled trials, prospective studies, or diagnostic studies (eg, improper randomization, no blinding, < 80% follow-up)
III	Case controlled studies or retrospective studies
IV	Case series
V	Expert opinion

GRADES OF EVIDENCE

The overall strength of the evidence supporting recommendations made in this guideline will be graded according to guidelines described by Guyatt et al,[71] as modified by MacDermid and adopted by the coordinator and reviewers of this project. In this modified system, the typical A, B, C, and D grades of evidence have been modified to include the role of consensus expert opinion and basic science research to demonstrate biological or biomechanical plausibility (Table 2 below).

GRADES OF RECOMMENDATION		STRENGTH OF EVIDENCE
A	Strong evidence	A preponderance of level I and/or level II studies support the recommendation. This must include at least 1 level I study
B	Moderate evidence	A single high-quality randomized controlled trial or a preponderance of level II studies support the recommendation
C	Weak evidence	A single level II study or a preponderance of level III and IV studies including statements of consensus by content experts support the recommendation
D	Conflicting evidence	Higher-quality studies conducted on this topic disagree with respect to their conclusions. The recommendation is based on these conflicting studies
E	Theoretical/ foundational evidence	A preponderance of evidence from animal or cadaver studies, from conceptual models/principles, or from basic sciences/bench research support this conclusion
F	Expert opinion	Best practice based on the clinical experience of the guidelines development team

Methods *(continued)*

REVIEW PROCESS

The Orthopaedic Section, APTA also selected consultants from the following areas to serve as reviewers of the early drafts of this clinical practice guideline:

- Claims review
- Coding
- Epidemiology
- Medical practice guidelines
- Orthopaedic physical therapy residency education
- Physical therapy academic education
- Sports physical therapy residency education

Comments from these reviewers were utilized by the authors to edit this clinical practice guideline prior to submitting it for publication to the Journal of Orthopaedic & Sports Physical Therapy

In addition, several physical therapists practicing in orthopaedic and sports physical therapy settings were sent initial drafts of this clinical practice guideline along with feedback forms to determine its usefulness, validity, and impact. All returned feedback forms from these practicing clinicians described this clinical practice guideline as:

- "Moderately useful" or "extremely useful"
- An "accurate representation of the peer-reviewed literature"
- A guideline that will have a "substantial positive impact on orthopaedic physical therapy patient care"

However, several reviewers noted that preliminary drafts of this clinical guideline did not clearly link data gathered during the patient's subjective and physical examinations to diagnostic classification and intervention. To assist in clarifying these links, it was recommended that the authors add a table to these clinical guidelines that provides a summary of symptoms, impairment findings, and matched interventions for each diagnostic category. This recommendation led the authors to add Table 4 to these clinical guidelines.

CLASSIFICATION

The primary ICD-10 codes and conditions associated with neck pain are: M54.2 Cervicalgia, M54.6 Pain in thoracic spine, R51 Headache, M53.0 Cervicocranial syndrome, S13.4 Sprain and strain of cervical spine, M47.2 Spondylosis with radiculopathy, and M50.1 Cervical disc disorder with radiculopathy.[87] The corresponding ICD-9 CM codes and conditions, which are used in the USA, are 723.1 Cervicalgia, 724.1 Pain in thoracic spine, 784.0 Headache, 723.2 Cervicocranial syndrome, 847.0 Sprains and strains of the neck, and 723.4 Brachial neuritis or radiculitis, not otherwise specified (Cervical radiculitis/Radicular syndrome of upper limbs).

The primary ICF body function codes associated with the above noted ICD-10 conditions are the sensory functions related to pain and the movement functions related to joint motion and control of voluntary movements. These body function codes are **b7101 Mobility of several joints, b28010 Pain in head and neck, b7601 Control of complex voluntary movements, and b2803 Radiating pain in a dermatome.**

The primary ICF body structure codes associated with neck pain are **s7103 Joints of head and neck region, s7104 Muscles of head and neck region, s7105 Ligaments and fasciae of head and neck region, s76000 Cervical vertebral column, and s1201 Spinal nerves.**

The primary ICF activities and participation codes associated with neck pain are **d4108 Changing a basic body position, d4158 Maintaining a body position, and d4452 Reaching.**

The ICD-10 and primary and secondary ICF codes associated with neck pain are provided in Table 3 (below).

ICD-10 and ICF Codes Associated With Neck Pain

INTERNATIONAL STATISTICAL CLASSIFICATION OF DISEASES AND RELATED HEALTH PROBLEMS		
Neck Pain With Mobility Deficits		
Primary ICD-10	M54.2 M54.6	Cervicalgia Pain in thoracic spine
Neck Pain With Headaches		
Primary ICD-10	R51 M53.0	Headache Cervicocranial syndrome
Neck Pain With Movement Coordination Impairments		
Primary ICD-10	S13.4	Sprain and strain of cervical spine
Neck Pain With Radiating Pain		
Primary ICD-10	M47.2 M50.1	Spondylosis with radiculopathy Cervical disc disorder with radiculopathy

INTERNATIONAL CLASSIFICATION OF FUNCTIONING, DISABILITY, AND HEALTH

PRIMARY ICF CODES

Neck Pain With Mobility Deficits		
Body functions	b7101	Mobility of several joints
Body structure	s76000	Cervical vertebral column
Activities and participation	d4108	Changing a basic body position, specified as moving the head and neck while looking to the left or to the right
Neck Pain With Headaches		
Body functions	b28010	Pain in head and neck
Body structure	s7103 s7104	Joints of head and neck region Muscles of head and neck region
Activities and participation	d4158	Maintaining a body position, specified as maintaining the head in a flexed position, such as when reading a book; or, maintaining the head in an extended position, such as when looking up at a video monitor
Neck Pain With Movement Coordination Impairments		
Body functions	b7601	Control of complex voluntary movements
Body structure	s7105	Ligaments and fasciae of head and neck region
Activities and participation	d4158	Maintaining a body position, specified as maintaining alignment of the head, neck, and thorax such that the cervical vertebral segments function in a neutral, or mid-range, position
Neck Pain With Radiating Pain		
Body functions	b2804	Radiating pain in a segment or region
Body structure	s1201	Spinal nerves
Activities and participation	d4452	Reaching

SECONDARY ICF CODES

Neck Pain With Mobility Deficits		
Body functions	b28010 b28013 b28014 b7101 b7151 b7305 b7350 b7400 b7601	Pain in head and neck Pain in back Pain in upper limb Mobility of several joints Stability of several joints Power of muscles of the trunk Tone of isolated muscles and muscle groups Endurance of isolated muscles Control of complex voluntary movements
Body structure	s12001 s130 s7103 s7104 s7105 s76000 s76001 s7601 s7602	Thoracic spinal cord Structure of meninges Joints of head and neck region Muscles of head and neck region Ligaments and fasciae of head and neck region Cervical vertebral column Thoracic vertebral column Muscles of trunk Ligaments and fasciae of trunk

INTERNATIONAL CLASSIFICATION OF FUNCTIONING, DISABILITY, AND HEALTH *(CONTINUED)*

Activities and participation	d2302	Completing the daily routine
	d2400	Handling responsibilities
	d4100	Lying down
	d4105	Bending
	d4150	Maintaining a lying position
	d4750	Driving human-powered transportation
	d4751	Driving motorized vehicles
	d4752	Driving animal-powered transportation
	d4554	Swimming
	d6409	Doing housework, unspecified
	d9109	Community life, unspecified
	d9209	Recreation and leisure, unspecified
Neck Pain With Headaches		
Body functions	b2803	Radiating pain in a dermatome
	b2804	Radiating pain in a segment or region
	b7101	Mobility of several joints
	b7151	Stability of several joints
	b7305	Power of muscles of the trunk
	b7350	Tone of isolated muscles and muscle groups
	b7400	Endurance of isolated muscles
	b7601	Control of complex voluntary movements
	b2359	Vestibular functions, unspecified
	b2409	Sensations associated with hearing and vestibular function, unspecified
Body structure	s12000	Cervical spinal cord
	s12001	Thoracic spinal cord
	s1201	Spinal nerves
	s130	Structure of meninges
	s7105	Ligaments and fasciae of head and neck region
	s76001	Thoracic vertebral column
	s76000	Cervical vertebral column
	s7601	Muscles of trunk
Activities and participation	d163	Thinking
	d166	Reading
	d2302	Completing the daily routine
	d2400	Handling responsibilities
	d4150	Maintaining a lying position
	d4153	Maintaining a sitting position
	d4154	Maintaining a standing position
	d4750	Driving human-powered transportation
	d4751	Driving motorized vehicles
	d4752	Driving animal-powered transportation
	d6409	Doing housework, unspecified
	d9109	Community life, unspecified
	d9209	Recreation and leisure, unspecified
Neck Pain With Movement Coordination Impairments		
Body functions	b28010	Pain in head and neck
	b28013	Pain in back
	b28014	Pain in upper limb
	b7151	Stability of several joints
	b7305	Power of muscles of the trunk
	b7400	Endurance of isolated muscles
	b7602	Coordination of voluntary movements

INTERNATIONAL CLASSIFICATION OF FUNCTIONING, DISABILITY, AND HEALTH *(CONTINUED)*		
Body structure	s7103 s7104 s76000 s76001 s7601 s7602	Joints of head and neck region Muscles of head and neck region Cervical vertebral column Thoracic vertebral column Muscles of trunk Ligaments and fasciae of trunk
Activities and participation	d2302 d2400 d4105 d4153 d4154 d4750 d4751 d4752 d6409 d9109 d9209	Completing the daily routine Handling responsibilities Bending Maintaining a sitting position Maintaining a standing position Driving human-powered transportation Driving motorized vehicles Driving animal-powered transportation Doing housework, unspecified Community life, unspecified Recreation and leisure, unspecified
Neck Pain With Radiating Pain		
Body functions	b28013 b28014 b2803 b7101 b7151 b7305 b7350 b7400 b7601	Pain in back Pain in upper limb Radiating pain in a dermatome Mobility of several joints Stability of several joints Power of muscles of the trunk Tone of isolated muscles and muscle groups Endurance of isolated muscles Control of complex voluntary movements
Body structure	s12000 s12001 s1201 s130 s7105 s76000 s76001 s7601 s7602	Cervical spinal cord Thoracic spinal cord Spinal nerves Structure of meninges Ligaments and fasciae of head and neck region Cervical vertebral column Thoracic vertebral column Muscles of trunk Ligaments and fasciae of trunk
Activities and participation	d2302 d2400 d4150 d4153 d4154 d4300 d4301 d4302 d4303 d4304 d4305 d4750 d4751 d4752 d6409 d9109 d9209	Completing the daily routine Handling responsibilities Maintaining a lying position Maintaining a sitting position Maintaining a standing position Lifting Carrying in the hands Carrying in the arms Carrying on shoulders, hip, and back Carrying on the head Putting down objects Driving human-powered transportation Driving motorized vehicles Driving animal-powered transportation Doing housework, unspecified Community life, unspecified Recreation and leisure, unspecified

CLINICAL GUIDELINES

Impairment/Function-based Diagnosis

PREVALENCE

Pain and impairment of the neck is common. It is estimated that 22% to 70% of the population will have neck pain some time in their lives.[19,20,42,43,55,115,129] In addition, it has been suggested that the incidence of neck pain is increasing.[126,181] At any given time, 10% to 20% of the population reports neck problems,[19,44,78,167] with 54% of individuals having experienced neck pain within the last 6 months.[42] Prevalence of neck pain increases with age and is most common in women around the fifth decade of life.[4,19,46,116,163]

Although the natural history of neck pain appears to be favorable,[51,92] rates of recurrence and chronicity are high.[15,81] One study reported that 30% of patients with neck pain will develop chronic symptoms, with neck pain of greater than 6 months duration affecting 14% of all individuals who experience an episode of neck pain.[19] Additionally, a recent survey demonstrated that 37% of individuals who experience neck pain will report persistent problems for at least 12 months.[44] Five percent of the adult population with neck pain will be disabled by the pain, representing a serious health concern.[19,88] In a survey of workers with injuries to the neck and upper extremity, Pransky et al[135] reported that 42% missed more than 1 week of work and 26% experienced recurrence within 1 year. The economic burden due to disorders of the neck is high, and includes costs of treatment, lost wages, and compensation expenditures.[16,138] Neck pain is second only to low back pain in annual workers' compensation costs in the United States.[181] In Sweden, neck and shoulder problems account for 18% of all disability payments.[126] Jette et al[91] reported that patients with neck pain make up approximately 25% of patients receiving outpatient physical therapy. Additionally, patients with neck pain frequently are treated without surgery by primary care and physical therapy providers.[17,51,92]

PATHOANATOMICAL FEATURES

A variety of causes of neck pain have been described and include osteoarthritis, discogenic disorders, trauma, tumors, infection, myofascial pain syndrome, torticollis, and whiplash.[121] Unfortunately, clearly defined diagnostic criteria have not been established for many of these entities. Similar to low back pain, a pathoanatomical cause is not identifiable in the majority of patients who present with complaints of neck pain and neck related symptoms of the upper quarter.[15] Therefore, once serious medical pathology (such as cervical fracture or myelopathy) has been ruled out, patients with neck pain are often classified as having either a nerve root compromise or a "mechanical neck disorder."

II In some conditions, particularly those that are degenerative in nature or involve abnormalities of the vertebral motion segment, abnormal findings are not always associated with symptoms. Fourteen to 18% of people without neck pain demonstrate a wide range of abnormalities with imaging studies, including disc protrusion or extrusion and impingement of the thecal sac on the nerve root and spinal cord.[12] However, degenerative changes are still suggested to be a possible cause of mechanical neck pain in some cases,[109,130,131] despite the fact that these changes are present in asymptomatic individuals, are non-specific, and are highly prevalent in the elderly.[168] Disorders such as cervical radiculopathy and cervical compressive myelopathy are reported to be caused by space-occupying lesions (osteophytosis or herniated cervical disc). These may be secondary to degenerative processes and can give rise to neck and/or upper quarter pain as well as neurologic signs and symptoms.[136] While cervical disc herniation and spondylosis are most commonly linked to cervical radiculopathy and myelopathy,[10,136] the bony and ligamentous tissues affected by these conditions are themselves pain generators and are capable of giving rise to some of the referred symptoms observed in patients with these disorders.[13,40]

II Because most patients with neck pain usually lack an identifiable pathoanatomic cause for their problem, the majority are classified as having mechanical neck disorders.[82]

E Although the cause of neck pain may be associated with degenerative processes or pathology identified during diagnostic imaging, the tissue that is causing a patient's neck pain is most often unknown. Thus, clinicians should assess for impaired function of muscle, connective, and nerve tissues associated with the identified pathological tissues when a patient presents with neck pain.

RISK FACTORS

II

Bot and colleagues[18] investigated the clinical course and predictors of recovery for patients with neck and shoulder pain. Four hundred forty three patients who consulted their primary care physician with neck or shoulder symptoms were followed for 12 months. At 12 months, 32% of patients reported that they had recovered. Predictors of poor pain-related outcome at 12 months included less intense pain at baseline, a history of neck and shoulder symptoms, more worrying, worse perceived health, and a moderate or bad quality of life. The predictors for a poor disability-related response at 12 months included older age, less disability at baseline, longer duration of symptoms, loss of strength in hands, having multiple symptoms, more worrying, moderate or bad quality of life, and less vitality.

II

Hill and colleagues[76] investigated the course of neck pain in an adult population over a 12 month period. Significant baseline characteristics, which predicted persistent neck pain were age (45-59 years), being off work at the time of the baseline survey (odds ratio [OR] = 1.6), comorbid low back pain (OR = 1.6), and bicycling as a regular activity (OR = 2.4).

II

In a prospective cohort study, Hoving et al[80] examined the predictors of outcome in a patient population with neck pain. A total of 183 patients participated in the study of which 63% had improved at a 12-month follow-up. In the short term, older age (⩾40), concomitant low back pain, and headache were associated with poor outcome. In the long-term, in addition to age and concomitant low back pain, previous trauma, a long duration of neck pain, stable neck pain during the 2 weeks prior to baseline measurement, and previous neck pain predicted poor prognosis.

B

Clinicians should consider age greater than 40, coexisting low back pain, a long history of neck pain, bicycling as a regular activity, loss of strength in the hands, worrisome attitude, poor quality of life, and less vitality as predisposing factors for the development of chronic neck pain.

CLINICAL COURSE

Approximately 44% of patients experiencing neck pain will go on to develop chronic symptoms,[15] and many will continue to exhibit moderate disability at long-term follow-up.[66] A recent systematic review examined the outcomes of nontreatment control groups in clinical trials for the conservative management of chronic mechanical neck pain - not due to whiplash.[171] The outcomes of patients receiving a control or placebo intervention were analyzed and effect sizes were calculated. The changes in pain scores over the varying trial periods in these untreated subjects with chronic mechanical neck pain were consistently small and not significant.[171]

Conversely, there is substantial evidence that favorable outcomes are attained following treatment of patients with cervical radiculopathy.[79,136] For example, Radhakrishnan and colleagues[136] reported that nearly 90% of patients with cervical radiculopathy presented with only mild symptoms at a median follow-up of 4.9 years. Honet and Puri[79] found that 70% of patients with cervical radiculopathy exhibited good or excellent outcomes after a 2-year follow-up. Outcomes for the patients in the aforementioned studies[79,136] appeared favorable and suggest that 70-90% of this population can experience improvement without surgical intervention. In contrast, the clinical prognosis of patients with whiplash-associated disorder is less favorable. A survey of 108 patients with a history of whiplash requiring care at an emergency department found that 55% had residual pain/disability referable to the original accident at a mean follow-up of 17 years later. Neck pain, radiating pain, and headache were the most common symptoms. Thirty-three percent of the respondents with residual symptoms suffered from work disability, compared to 6% in the group of patients without residual disorders.[25]

DIAGNOSIS/CLASSIFICATION

III

Strategies for the classification of patients with neck pain have been recently proposed by Wang et al,[177] Childs et al,[27] and Fritz and Brennan.[62] The underlying premise is that classifying patients into groups based on clinical characteristics and matching these patient subgroups to management strategies likely to benefit them will improve the outcome of physical therapy interventions.[27] The classification system described by Wang et al[177] categorized patients into 1 of 4 subgroups based on the area of symptoms and the presumed source of the symptoms. The labels of these 4 categories were neck pain only, headaches, referred arm pain and neck pain, and radicular arm pain and neck pain. Distinct treatment approaches were linked to each of the 4 categories. Wang et al[177] reported the results of 30 patients treated using this classification strategy as well as 27 patients who were not treated. Statistically and clinically significant reductions in pain and disability were reported for the classification group only.[177] It is difficult to draw conclusions regarding the potential usefulness of the Wang et al[177] classification system because patients in the control group were not treated, which is not reflective of physical therapy practice. The classification system described by Childs et al[27] and Fritz and Brennan[62] uses information from the history and physical examination to place patients into 1 of 5 separate treatment subgroups. The labels of these 5 subgroups, which are mobility, centralization, exercise and conditioning, pain control, and headache, intend to capture the primary focus or goal of treatment. Fritz and Brennan,[62] utilizing a prospective, observational study of 274 patients, reported that patients who received interventions matched with their treatment subgroup had better outcomes than patients who received interventions that were not matched with their subgroup. The classification system described in this practice guideline linked to the ICF, parallels the Childs et al[27] and Fritz and Brennan[62] classification with 2 noteworthy differences. The first difference is that the labels in this clinical practice guideline incorporate the following ICF impairments of body functions terminology: Neck pain with mobility deficits, neck pain with headaches, neck pain with movement coordination impairments, and neck pain with radiating pain. The second difference is that Fritz and Brennan's[62] "pain control" category, which was linked to mobilization and range of motion exercises following an acute cervical sprain, was divided into the "neck pain with movement coordination impairments," and "neck pain with mobility deficits" categories, where the patient would receive interventions linked to the most relevant impairment(s) exhibited at a given period during the patient's episode of care.

I The ICD diagnosis of cervicalgia, or pain in thoracic spine and the associated ICF diagnosis of neck pain with mobility deficits is made with a reasonable level of certainty when the patient presents with the following clinical findings[33,62,82,166]:

- Younger individual (age <50 years)
- Acute neck pain (duration <12 weeks)
- Symptoms isolated to the neck
- Restricted cervical range of motion

II The ICD diagnosis of headaches, or cervicocranial syndrome and the associated ICF diagnosis of neck pain with headaches is made with a reasonable level of certainty when the patient presents with the following clinical findings[6,62,99,185]:

- Unilateral headache associated with neck/suboccipital area symptoms that are aggravated by neck movements or positions
- Headache produced or aggravated with provocation of the ipsilateral posterior cervical myofascia and joints
- Restricted cervical range of motion
- Restricted cervical segmental mobility
- Abnormal/substandard performance on the cranial cervical flexion test

I The ICD diagnosis of sprain and strain of cervical spine and the associated ICF diagnosis of neck pain with movement coordination impairments is made with a reasonable level of certainty when the patient presents with the following clinical findings[22,29,145,162,182,184]:

- Longstanding neck pain (duration >12 weeks)
- Abnormal/substandard performance on the cranial cervical flexion test
- Abnormal/substandard performance on the deep flexor endurance test
- Coordination, strength, and endurance deficits of neck and upper quarter muscles (longus colli, middle trapezius, lower trapezius, serratus anterior)
- Flexibility deficits of upper quarter muscles (anterior/middle/posterior scalenes, upper trapezius, levator scapulae, pectoralis minor, pectoralis major)
- Ergonomic inefficiencies with performing repetitive activities

II The ICD diagnosis of spondylosis with radiculopathy or cervical disc disorder with radiculopathy and the associated ICF diagnosis of neck pain with radiating pain is made with a reasonable level of certainty when the patient presents with the following clinical findings[175]:

- Upper extremity symptoms, usually radicular or referred pain, that are produced or aggravated with Spurling's maneuver and upper limb tension tests, and reduced with the neck distraction test
- Decreased cervical rotation (<60°) toward the involved side
- Signs of nerve root compression
- Success with reducing upper extremity symptoms with initial examination and intervention procedures

B Neck pain, without symptoms or signs of serious medical or psychological conditions, associated with (1) motion limitations in the cervical and upper thoracic regions, (2) headaches, and (3) referred or radiating pain into an upper extremity are useful clinical findings for classifying a patient with neck pain into the following International Statistical Classification of Diseases and Related Health Problems (ICD) categories: cervicalgia, pain in thoracic spine, headaches, cervicocranial syndrome, sprain and strain of cervical spine, spondylosis with radiculopathy, and cervical disc disorder with radiculopathy; and the associated International Classification of Functioning, Disability, and Health (ICF) impairment-based category of neck pain with the following impairments of body function:

- Neck pain with mobility deficits (b7101 Mobility of several joints)
- Neck pain with headaches (28010 Pain in head and neck)
- Neck pain with movement coordination impairments (b7601 Control of complex voluntary movements)
- Neck pain with radiating pain (b2804 Radiating pain in a segment or region)

The following physical examination measures may be useful in classifying a patient in the ICF impairment-based category of neck pain with mobility deficits and the associated ICD categories of cervicalgia or pain in thoracic spine:

- Cervical active range of motion
- Cervical and thoracic segmental mobility

The following physical examination measures may be useful in classifying a patient in the ICF impairment-based category of neck pain with headaches and the associated ICD categories of headaches or cervicocranial syndrome:

- Cervical active range of motion
- Cervical segmental mobility
- Cranial cervical flexion test

The following physical examination measures may be useful in classifying a patient in the ICF impairment-based category of neck pain with movement coordination impairments and the associated ICD category of sprain and strain of cervical spine:

- Cranial cervical flexion test
- Deep neck flexor endurance

The following physical examination measures may be useful in classifying a patient in the ICF impairment-based category of neck pain with radiating pain and the associated ICD categories of spondylosis with radiculopathy or cervical disc disorder with radiculopathy:

- Upper limb tension test
- Spurling's test
- Distraction test

DIFFERENTIAL DIAGNOSIS

III A PRIMARY GOAL OF DIAGNOSIS IS TO MATCH THE patient's clinical presentation with the most efficacious treatment approach. A component of this decision is determining whether the patient is, in fact, appropriate for physical therapy management. In the vast majority of patients with neck pain, symptoms can be attributed to mechanical factors. However, in a much smaller percentage of patients, the cause of neck pain may be something more serious, such as cervical myelopathy, cervical instability,[49] fracture,[77] neoplastic conditions,[90,140,152,154] vascular compromise,[151] or systemic disease.[8,24] Clinicians must be aware of the key signs and symptoms associated with serious pathological neck conditions, continually screen for the presence of these conditions, and initiate referral to the appropriate medical practitioner when a potentially serious medical condition is suspected.

I When a patient with neck pain reports a history of trauma, the therapist needs to be particularly alert for the presence of cervical instability, spinal fracture, and the presence of or potential for spinal cord or brain stem injury. A clinical prediction rule has been developed to assist clinicians in determining when to order radiographs in individuals who have experienced trauma.[159]

II In addition to medical conditions, clinicians should be aware of psychosocial factors that may be contributing to a patient's persistent pain and disability, or that may contribute to the transition of an acute condition to a chronic, disabling condition. Researchers have recently shown that psychosocial factors are an important prognostic indicator of prolonged disability.[63,64,114,150] When relevant psychosocial factors are identified, the rehabilitation approach may need to be modified to emphasize active rehabilitation, graded exercise programs, positive reinforcement of functional accomplishments, and/or graduated exposure to specific activities that a patient fears as potentially painful or difficult to perform.[65]

B Clinicians should consider diagnostic classifications associated with serious pathological conditions or psychosocial factors when the patient's reported activity limitations or impairments of body function and structure are not consistent with those presented in the diagnosis/classification section of this guideline, or, when the patient's symptoms are not resolving with interventions aimed at normalization of the patient's impairments of body function.

IMAGING STUDIES

ADULTS WITH CERVICAL PAIN PRECIPITATED BY TRAUMA should be classified as low risk or high risk based on the Canadian Cervical Spine Rule (CCR) for radiography in alert and stable trauma patients[159] and the 2001 American College of Radiology (ACR) suspected Spine Trauma Appropriateness Criteria.[3] According to the CCR, patients who (1) are able to sit in the emergency department; or (2) have had a simple rear-end motor vehicle collision; or (3) are ambulatory at any time; or (4) have had a delayed onset of neck pain; or (5) do not have midline cervical spine tenderness; and (6) are able to actively rotate their head 45° in each direction, are classified as low risk. Those who are classified as low risk do not require imaging for acute conditions. Patients who are (1) greater than 65 years of age; or (2) have had a dangerous mechanism of injury; or (3) have paresthesias in the extremities, are classified as high risk.[159] Those classified as high risk should undergo cervical radiography.[9,47]

There is a paucity of available literature regarding the pediatric population to help guide decision making on the need for imaging. Adult risk classification features should be applied in children greater than age 14. Due to the added radiation exposure of computed tomography the ACR recommends plain radiography (3 views) in those under 16 years of age regardless of mental status.[3]

There is no consensus for routine investigation of patients with chronic neck pain with imaging beyond plain radiographs.[3,48] Routine use of ultrasonography, CT, and magnetic resonance imaging (MRI) in patients without neurologic insult or other disease has not been justified in view of the infrequency of abnormalities detected, the lack of prognostic value, inaccessibility, and the high cost of the procedures.[14,73,119,133,141,146,174] A major limitation is the lack of specific findings in patients with neck disorder and no definite correlation between the patient's subjective symptoms and abnormal findings seen on imaging studies. As a result, debate continues as to whether persistent pain is attributable to structural pathology or to other underlying causes.

Recently, Kristjansson[111] compared sagittal plane, rotational, and translational cervical segmental motion in women with (1) persistent whiplash-associated disorder (WAD) (grades I and II), (2) persistent non-traumatic, insidious onset of neck pain, and (3) normal values of rotational and translational motion. Lateral radiographic analysis revealed significantly increased rotational motion at C3-4 and C4-5 for individuals in the WAD and insidious groups, significantly excessive translational motion at C3-4 for individuals in the WAD and insidious groups, and significantly excessive translational motion at C5-6 for individuals in the WAD group when compared to normal subjects.

Ultrasonography has been used to accurately measure the size of the cervical multifidus muscle at the C4 level in asymptomatic female subjects. For those with chronic WAD, ultrasonography did not accurately measure the cervical multifidus because the fascial borders of the multifidus were largely indistinguishable, indicating possible pathological conditions.[110]

High resolution proton density-weighted MRI has recently demonstrated abnormal signal intensity (indicative of tissue damage) in both the alar and transverse ligaments in some subjects with chronic WAD.[108] Later follow-up studies indicated a strong relationship between alar ligament damage, head position (turned) at time of impact, and disability levels (as measured with the Neck Disability Index).[101,102,107]

Elliott et al[53] have demonstrated that female patients (18-45 years old) with persistent WAD (grade II) show MRI changes in the fat content of the cervical extensor musculature that were not present in subjects with chronic insidious onset neck pain or healthy controls. It is currently unclear whether the patterns of fatty infiltration are the result of local structural trauma causing a general inflammatory response, a specific nerve injury or insult, or a generalized disuse phenomenon. Further, as the muscular changes were observed in the chronic state, it is not yet known whether they occur uniformly in all people who have sustained whiplash injury irrespective of recovery or are unique to only those who develop chronic symptoms.

In addition to fatty infiltration, Elliott et al[54] have identified changes in the relative cross-sectional area (rCSA) of the cervical paraspinal musculature in patients with chronic WAD relative to control subjects with no history of neck pain. Specifically, the WAD group demonstrated a consistent pattern of larger rCSA in the multifidii muscles at each segment (C3-C7). Inference can be drawn that the larger rCSAs recorded in the multifidii muscles of those with chronic WAD are the result of larger amounts of fatty infiltrate.

In summary, imaging studies often fail to identify any structural pathology related to symptoms in patients with neck disorder and in particular, whiplash injury. However, emerging evidence into upper cervical ligamentous disruption, altered segmental motion, and muscular degeneration has been demonstrated with radiographs, ultrasonography, and MRI studies. It remains unknown if (1) these findings are unique to chronic WAD; (2) whether they relate to patients' physical signs and symptoms, and (3) whether specific physical therapy intervention can alter such degeneration. Such knowledge may offer prognostic information and provide the foundation for interventional based studies.

CLINICAL GUIDELINES

Examination

OUTCOME MEASURES

I — THE NECK DISABILITY INDEX (NDI) IS A COMMONLY utilized outcome measure to capture perceived disability in patients with neck pain.[134] The NDI contains 10 items, 7 related to activities of daily living, 2 related to pain, and 1 related to concentration.[172] Each item is scored from 0-5 and the total score is expressed as a percentage, with higher scores corresponding to greater disability. Riddle and Stratford[139] identified a significant association between the NDI and both the physical and mental health components of the SF-36. The authors also identified that the NDI possesses adequate sensitivity as compared to the magnitude of change that occurred for patients reaching their functional goals, work status, and if the patient was currently in litigation.[139] Jette and Jette[92] further substantiated the sensitivity to change by calculating the effect sizes for change scores of both the NDI and SF-36.

Two studies[161,179] with small sample sizes have identified the minimal detectable change, or the amount of change that must be observed before the change can be considered to exceed the measurement error, for the NDI. Westaway[179] identified the minimal detectable change as 5 (10 percentage points) in a group of 31 patients with neck pain. Stratford and colleagues[161] identified the minimal detectable change also to be 5 (10 percentage points) in a group of 48 patients with neck pain. However, the minimum clinically important difference, the smallest difference which patients perceive as beneficial, may be more useful to clinicians.[89] Stratford and colleagues[161] identified the minimal clinically important difference as 5 points (10 percentage points). More recently, Cleland and colleagues,[35] described the minimum clinically important difference for the NDI to be 9.5 (19 percentage points) for patients with mechanical neck disorders.

The NDI has demonstrated moderate test re-test reliability and has been shown to be a valid health outcome measure in a patient population with cervical radiculopathy.[37] In this group, the intraclass correlation coefficient (ICC) for test retest reliability was 0.68 for the NDI and the minimum clinically important difference was 7 (14 percentage points).[37]

I — The Patient-Specific Functional Scale (PSFS) is a practical alternative or supplement to generic and condition-specific measures.[179] The PSFS asks patients to list 3 activities that are difficult as a result of their symptoms, injury, or disorder. The patient rates each activity on a 0-10 scale, with 0 representing the inability to perform the activity, and 10 representing the ability to perform the activity as well as they could prior to the onset of symptoms.[160] The final PSFS score is the average of the 3 activity scores. The PSFS was developed by Stratford et al[160] in an attempt to present a standardized measure for recording a patient's perceived level of disability across a variety of conditions. The PSFS has been evaluated for reliability and validity in patients with neck pain.[179] The ICC value for test retest reliability in patients with cervical radiculopathy was 0.82.[37] The minimal detectable change in that population was identified to be 2.1 points with a minimum clinically important difference of 2.0.[37]

A — Clinicians should use validated self-report questionnaires, such as the Neck Disability Index and the Patient-Specific Functional Scale for patients with neck pain. These tools are useful for identifying a patient's baseline status relative to pain, function, and disability and for monitoring a change in patient's status throughout the course of treatment.

ACTIVITY LIMITATION AND PARTICIPATION RESTRICTION MEASURES

V — THERE ARE NO ACTIVITY LIMITATION AND PARTICIPATION restriction measures specifically reported in the literature associated with neck pain - other than those that are part of the self-report questionnaire noted in this guideline's section on Outcome Measures. However, the following measures are options that a clinician may use to assess changes in a patient's level of function over an episode of care.

- Pain level at end ranges of looking over shoulder
- Pain level at end ranges of looking down
- Pain level at end ranges of looking up
- Pain level after sitting for 2 hours
- Number of times per night that pain disrupts sleep
- Deskwork tolerance (in number of minutes or hours)
- Percent of time experiencing neck pain over the previous 24 hours
- Percent of time experiencing headache(s) over the previous month

In addition, the Patient-Specific Functional Scale is a questionnaire that can be used to quantify changes in activity limitations and participation restrictions for patients with neck pain.[160] This scale enables the clinician to collect measures related to function that may be different then the measures that are components of the region-specific outcome measures section such as the Neck Disability Index.[179]

F Clinicians should utilize easily reproducible activity limitation and participation restriction measures associated with their patient's neck pain to assess the changes in the patient's level of function over the episode of care.

PHYSICAL IMPAIRMENT MEASURES

Cervical Active Range of Motion

ICF category	Measurement of impairment of body function – mobility of several joints
Description	The amount of active neck flexion, extension, rotation, and sidebending motion measured using an inclinometer
Measurement method	All cervical range of motion (ROM) measures are performed in the upright sitting position. Care should be taken to ensure the patient maintains an upright sitting position throughout the examination and during subsequent follow-up examinations. The following procedures are used to measure the ROM for the cervical spine. **Neck Flexion/Extension:** For neck flexion, the inclinometer is placed on the top of the patient's head aligned with the external auditory meatus and then zeroed. The patient is asked to flex the head forward as far as possible, bringing the chin to the chest. The amount of neck flexion is recorded from the inclinometer. For extension ROM, the inclinometer is positioned in the same manner, and the patient is asked to extend the neck backwards as far as possible. The amount of neck extension is recorded with the inclinometer. **Neck Sidebending:** The inclinometer is positioned in the frontal plane on the top of the patient's head in alignment with the external auditory meatus. To measure right sidebending, the patient is asked to move the right ear to the right shoulder. The amount of sidebending is recorded with the inclinometer. The opposite is performed to measure left sidebending. Care should be taken to avoid concomitant rotation or flexion with the sidebending movement. **Neck Rotation:** Rotation can be measured with a universal/standard goniometer. The patient is seated, looking directly forward with the neck in neutral position. The fulcrum of the goniometer is placed over the top of the head with the stationary arm aligned with the acromion process of the shoulder, and the moveable arm bisecting the patient's nose. The patient is asked to rotate in each direction as far as possible.
Nature of variable	Continuous
Units of measurement	Degrees
Measurement properties	Cervical ROM measurements for flexion, extension, and sidebending using a bubble inclinometer have exhibited reliability coefficients ranging from 0.66 to 0.84 ($ICC_{2,1}$).[32,175]
Instrument variations	In addition to using an inclinometer,[5,83,128,180] cervical ROM can also be measured for clinical purposes using a cervical range of motion (CROM) device[113,165] or a tape measure. All methods are moderately correlated with more definitive radiographic and 3D kinematic measurement.[4,5]

Cervical And Thoracic Segmental Mobility

ICF category	Measurement of impairment of body function – mobility of single joints
Description	With the patient prone, cervical and thoracic spine segmental movement and pain response are assessed
Measurement method	The patient is prone. The examiner contacts each cervical spinous process with the thumbs. The lateral neck musculature is gently pulled slightly posterior with the fingers. The examiner should be directly over the contact area keeping elbows extended, then he/she uses the upper trunk to impart a posterior to anterior force in a progressive oscillatory fashion over the spinous process. This is repeated for each cervical segment. The examiner then changes his/her contact position and places the hypothenar eminence (just distal to the pisiform) of one hand over the spinous process of each thoracic spinous process and repeats the same posterior to anterior forces in a progressive oscillatory fashion. The test result is considered to be positive if the patient reports reproduction of pain. The mobility of the segment is judged to be normal, hypermobile, or hypomobile. Interpretation of mobility is based on the examiner's perception of the mobility at each spinal segment relative to those above and below the tested segment, and based on the examiner's experience and perception of normal mobility.
Nature of variable	Nominal (pain response) and ordinal (mobility judgment)

Cervical And Thoracic Segmental Mobility (continued)

Units of measurement	None
Diagnostic accuracy and measurement properties	Diagnostic Accuracy[144]: Pain during segmental testing associated with reports of neck pain. Sensitivity = 0.82; negative likelihood ratio (-LR) = 0.23 Specificity = 0.79; positive likelihood ratio (+LR) = 3.9 Reliability for cervical spine assessment: Kappa = 0.14 to 0.37 (pain)[169] ICC = 0.42 to 0.79 (pain)[11] ICC = 0.78 to 1.0 (presence of joint dysfunction in upper 3 cervical spine segments)[100] Weighted kappa: -0.26 to 0.74 (mobility), -0.52 to 0.90 (pain)[32] Reliability for thoracic spine assessment: Weighted kappa: 0.13 to 0.82 (mobility), -0.11 to 0.90 (pain)[32]

Cranial Cervical Flexion Test

ICF category	Measurement of impairment of body function – control of simple voluntary movements and endurance of isolated muscles
Description	In supine, the ability to initiate and maintain isolated cranial and cervical flexion
Measurement method	Patient is positioned supine in hook lying and the head and neck in mid-range neutral (imaginary line between forehead and chin and imaginary line between the tragus of the ear and the neck longitudinally should be parallel to each other and the surface of the treatment table). Towels may be needed under the occiput to achieve this neutral position. A pneumatic pressure device, such as a pressure biofeedback unit, is inflated to 20 mmHg to fill the space between the cervical lordotic curve and the surface of the table (behind the suboccipital region, not below the lower cervical area). While keeping the posterior head/occiput stationary (do not lift, do not push down), the patient performs cranial cervical flexion (CCF) in a graded fashion in 5 increments (22, 24, 26, 28, and 30 mmHg) and aims to hold each position for 10 seconds. Ten seconds rest is provided between stages. To perform CCF, the patient is instructed to gently nod the head as though they were saying “yes” with the upper neck. This motion will flatten the cervical lordosis, thus changing the pressure in the pneumatic pressure device. While the patient is performing the test movement, the therapist palpates the neck to monitor for unwanted activation of the superficial cervical muscles, such as the sternocleidomastoid. The patient can place his/her tongue on the roof of the mouth, with lips together but the teeth slightly separated, to help decrease platysma and/or hyoid activation. The test is graded according to the pressure level the patient can achieve with concentric contractions and accurately sustain isometrically. The test is terminated when the pressure is decreased by more than 20% or when the patient cannot perform the proper CCF movement without substitution strategies. A normal response is for the pressure to increase to between 26-30 mmHg and be maintained for 10 seconds without utilizing superficial cervical muscle substitution strategies. An abnormal response is where the patient: 1. Is unable to generate an increase in pressure of at least 6 mmHg, 2. Is unable to hold the generated pressure for 10 seconds, 3. Uses superficial neck muscles to accomplish the cervical flexion motion, or 4. Uses a sudden movement of the chin or pushing (extending) the neck forcefully against the pressure device Scoring: • Activation Score: Pressure achieved and held for 10 second • Performance Index: Increase in Pressure × number of repetitions
Nature of variable	Continuous
Units of measurement	mmHg for the activation score
Measurement properties	Reliability assessment for 50 asymptomatic subjects, tested twice (1 week apart): Activation score: ICC=0.81; Performance Index: ICC=.93[96]

Neck Flexor Muscle Endurance Test

ICF category	Measurement of impairment of body function – endurance of isolated muscles
Description	In supine, the ability to lift the head and neck against gravity for an extended period

Neck Flexor Muscle Endurance Test (continued)

Measurement method	The test is performed in a supine, hook-lying position. With the chin maximally retracted and maintained isometrically, the patient lifts the head and neck until the head is approximately 2.5 cm (1 in) above the plinth while keeping the chin retracted to the chest. The clinician focuses on the skin folds along the patient's neck and places a hand on the table just below the occipital bone of the patient's head. Verbal commands (ie, "Tuck your chin" or "Hold your head up") are given when either the skin fold(s) begins to separate or the patient's occiput touches the clinician's hand. The test is terminated if the skin fold(s) is separated due to loss of chin tuck or the patient's head touches the clinician's hand for more than 1 second.[75]
Nature of variable	Continuous
Units of measurement	Seconds
Measurement properties	In a study by Harris et al,[75] 41 subjects with and without neck pain performed this test. Two raters tested all subjects at baseline, and subjects without neck pain were tested again 1 week later. Reliability: Subjects without neck pain: ICC (3,1) = 0.82 to 0.91, SEM 8.0 - 11.0 seconds ICC (2,1) = 0.67 to 0.78, SEM 12.6 - 15.3 seconds Subjects with neck pain: ICC (2,1) = 0.67, SEM 11.5 seconds Test results: Subjects without neck pain: Mean 38.95 seconds (SD=26.4) Subjects with neck pain: Mean 24.1 seconds (SD=12.8)

Upper Limb Tension Test

ICF category	Measurement of impairment of structure of the nervous system, other specified
Description	In non-weight bearing, the amount of mobility of the neural elements of the upper limb are assessed while determining whether the patient's upper quarter symptoms are elicited during performance of the test
Measurement method	Upper limb tension tests are performed with the patient supine. During performance of the upper limb tension test that places a bias toward testing the patient's response to tension placed on the median nerve, the examiner sequentially introduces the following movements to the symptomatic upper extremity: • Scapular depression • Shoulder abduction to about 90° with the elbow flexed • Forearm supination, wrist and finger extension • Shoulder lateral rotation • Elbow extension • Contralateral then ipsilateral cervical side-bending A positive test occurs when any of the following findings are present: 1. reproduction of all or part of the patient's symptoms 2. side-to-side differences of greater than 10° of elbow extension or wrist extension 3. on the symptomatic side, contralateral cervical side-bending increases the patient's symptoms, or ipsilateral side-bending decreases the patient's symptoms
Nature of variable	Nominal
Units of measurement	None
Diagnostic accuracy indices for the upper limb tension test, based on the study by Wainner et al[175]	(see below)

Index	Value	95% Confidence Interval
Kappa	0.76	0.51-1.0
Sensitivity	0.97	0.90-1.0
Specificity	0.22	0.12-0.33
Positive likelihood ratio	1.30	1.10-1.5
Negative likelihood ratio	0.12	0.01-1.9

Spurling's Test

ICF category	Measurement of impairment of structure of the nervous system, other specified

Spurling's Test (continued)

Description	Combination of sidebending to the symptomatic side coupled with compression to reduce the diameter of the neural foramen and elicit the patient's symptoms
Measurement method	The patient is seated and is asked to sidebend and slightly rotate the head to the painful side. The examiner places a compression force of approximately 7 kg through the top of the head in an effort to further narrow the intervertebral foramen. The test is considered positive when it reproduces the patient's symptoms. The test is not indicated if the patient has no upper extremity or scapular region symptoms.
Nature of variable	Nominal/dichotomous
Units of measurement	None

Diagnostic accuracy indices for Spurling's test, based on the study by Wainner et al[175]			95% Confidence Interval
	Kappa	0.60	0.32 - 0.87
	Sensitivity	0.50	0.27 - 0.73
	Specificity	0.86	0.77 - 0.94
	Positive likelihood ratio	3.50	1.60 - 7.50
	Negative likelihood ratio	0.58	0.36 - 0.94

Distraction Test

ICF category	Measurement of impairment of structure of the nervous system, other specified
Description	Distraction of the cervical spine to maximize the diameter of the neural foramen and reduce or eliminate the patient's symptoms
Measurement method	The distraction test is used to identify cervical radiculopathy and is performed with the patient supine. The examiner grasps under the chin and occiput, flexes the patient's neck to a position of comfort, and gradually applies a distraction force of up to approximately 14 kg. A positive test occurs with the reduction or elimination of the patient's upper extremity or scapular symptoms. This test is not indicated if the patient has no upper extremity or scapular region symptoms.
Nature of variable	Nominal
Units of measurement	None

Diagnostic accuracy indices for the upper limb tension test, based on the study by Wainner et al[175]			95% Confidence Interval
	Kappa	0.88	0.64 - 1.0
	Sensitivity	0.44	0.21 - 0.67
	Specificity	0.90	0.82 - 0.98
	Positive likelihood ratio	4.40	1.80 - 11.1
	Negative likelihood ratio	0.62	0.40 - 0.90

Valsalva Test

ICF category	Measurement of impairment of structure of the nervous system, other specified
Description	Maneuver in which the patient bears down without exhaling to increase intrathecal pressure and elicit upper quarter symptoms
Measurement method	The patient is seated and instructed to take a deep breath and hold it while attempting to exhale for 2-3 seconds. A positive response occurs with reproduction of symptoms.
Nature of variable	Nominal/dichotomous
Units of measurement	None

Diagnostic accuracy indices for the valsalva test, based on the study by Wainner et al[175]			95% Confidence Interval
	Kappa	0.69	0.36 - 1.0
	Sensitivity	0.22	0.03 - 0.41
	Specificity	0.94	0.88 - 1.0
	Positive likelihood ratio	3.50	0.97 - 12.6
	Negative likelihood ratio	0.83	0.64 - 1.1

CLINICAL GUIDELINES

Interventions

A variety of interventions have been described for the treatment of neck pain and there is good evidence from high-quality randomized, controlled trials and systematic reviews to support the benefits of physical therapy intervention in these patients.

CERVICAL MOBILIZATION/MANIPULATION

I

The most recent Cochrane Collaboration Review[69] of mobilization and manipulation for mechanical neck disorders included 33 randomized controlled trials of which 42% were considered high quality. They concluded that the most beneficial manipulative interventions for patients with mechanical neck pain with or without headaches should be combined with exercise to reduce pain and improve patient satisfaction. Manipulation (thrust) and mobilization (non-thrust manipulation) intervention alone were determined to be less effective than when combined with exercise (combined intervention).[69] A recently published clinical practice guideline concluded that the evidence for combined intervention was relatively strong, while the evidence for the effectiveness of thrust or non-thrust manipulation in isolation was weaker.[68]

The recommendations of the Cochrane Review[69] and the recently published clinical practice guideline[68] were based on key findings that warrant further discussion. Studies cited included patients with both acute[82]and chronic neck pain[22] and interventions consisted of soft-tissue mobilization and manual stretching procedures, as well as thrust,[17,83] and non-thrust manipulative procedures[82] directed at spinal motion segments. Number of visits ranged from 6 over a 3 week period[82] to 20 over an 11 week period[22] and the duration of sessions ranged from 30 minutes[99] to 60 minutes.[22] Combined intervention was compared with various competing interventions that included manipulation alone,[22,99] various non-manual physical therapy interventions,[82] high-tech and low-tech exercises,[22,82,99] general practitioner care (medication, advice, education),[82] and no treatment.[99] The majority of studies report either clinically or statistically important differences in pain in favor of combined intervention when compared to competing single interventions.[69] Differences in muscle performance[22,99] as well as patient satisfaction have also been reported for both short-term[22,82,99] as well as long-term outcomes 1[22] and 2 years later.[58] When compared to care rendered by a general practitioner and non-manual physical therapy interventions, the combination of manipulation and exercise resulted in significant cost-savings of up to 68%.[106]

II

Although many patients experience a significant benefit when treated with thrust manipulation, it is still unclear which patients benefit most. Tseng et al[166] reported 6 predictors for patients who experienced an immediate improvement in either pain, satisfaction, or perception of condition following manipulation of the cervical spine. These predictors included[166]:

- Initial scores on Neck Disability Index less than 11.5
- Having bilateral involvement pattern
- Not performing sedentary work more than 5 hours per day
- Feeling better while moving the neck
- Did not feel worse while extending the neck
- The diagnosis of spondylosis without radiculopathy

The presence of 4 or more of these predictors increased the probability of success with manipulation from 60% to 89%.[166] Predictors of which patients respond best to combined intervention have not been reported.

I

Nilsson et al[125] conducted a randomized, clinical trial (n=53) in individuals with cervicogenic headache. Subjects were randomized to receive high velocity low amplitude spinal manipulation or low level laser and deep friction massage. The use of analgesics were reduced by 36% in the manipulation group but were unchanged in the laser/massage group. The number of headache hours per day decreased by 69% for the individuals in the manipulation group and 37% in the laser/massage group. Headache intensity per episode decreased by 36% for those in the manipulation group and 17% in the laser/massage group.

II

A systematic review by Vernon et al,[171] which included studies published through 2005, concluded that there is moderate- to high-quality evidence that subjects with chronic neck pain and headaches show clinically important improvements from a course of spinal mobilization or manipulation at 6, 12, and up to 104 weeks post-treatment.

Despite good evidence to support the benefits of cervical mobilization/manipulation, it is important that physical therapists be aware of the potential risks in using these techniques.[68,69] However, it is impossible to determine the precise risk because (1) it is extremely difficult to quantify the number of cervical spine mobilization/manipulative interventions performed each year, and (2) not all adverse events occurring after mobilization/manipulation interventions are published in the peer-reviewed literature, and there is no accepted standard for reporting these injuries. Reported risk factors include hypertension, migraines, oral contraceptive use, and smoking.[72] However, the prevalence of these factors in the study by Haldeman et al[72] is largely the same or lower than that which occurs in the general population.

Although the true risk for complications remains unknown, the risk for serious complications is estimated to be 6 in 10 million (0.00006%) manipulations, with the risk of death being 3 in 10 million (0.000003%). Importantly, these rates are adjusted assuming that only 1 in 10 complications is actually reported in the literature.[84] Gross et al[70] recently reported, in a clinical practice guideline on the use of mobilization/manipulation in patients with mechanical neck pain, that estimates for serious complication for manipulation ranged from 1 in 20,000 (0.01%) to 5 in 10 million (0.0005%).[70]

The risk estimate for patients experiencing non-serious side effects such as increased symptoms, ranges from 1% to 2%.[149] The most common side effects included local discomfort (53%), local headache (12%), fatigue (11%), or radiating discomfort (10%). Patients characterized 85% of these complaints as mild or moderate, with 64% of side effects appearing within 4 hours after manipulation. Within 24 hours after manipulation, 74% of the complaints had resolved. Less than 5% of side effects were characterized as dizziness, nausea, hot skin, or other complaints. Side effects were rarely still noted on the day after manipulation, and very few patients reported the side effects as being severe.

Due the potential risk of serious adverse effects associated with cervical manipulation, such as vertebrobasilar artery stroke,[56] it has been recommended that non-thrust cervical mobilization/manipulation be utilized in favor of thrust manipulation.[50,85] However, information regarding the risk/benefit ratio of providing cervical thrust manipulation to patients with impairments of body function purported to benefit from cervical mobilization/manipulation, such as cervical segmental mobility deficits, has not been reported. In addition, the case reports in the literature describing serious adverse effects associated with cervical thrust manipulation do not provide information regarding either the presence of impairments of body functions, or the presence of red flags for vertebrobasilar insufficiency,[7] prior to the application of the manipulative procedure suspected to be linked with the reported harmful effects.

A Recommendation: Clinicians should consider utilizing cervical manipulation and mobilization procedures, thrust and non-thrust, to reduce neck pain and headache. Combining cervical manipulation and mobilization with exercise is more effective for reducing neck pain, headache, and disability than manipulation and mobilization alone.

THORACIC MOBILIZATION/MANIPULATION

A survey among clinicians that practice manual physical therapy reported that the thoracic spine is the region of the spine most often manipulated, despite the fact that more patients complain of neck pain.[1] While several randomized clinical trials have examined the effectiveness of thoracic spine thrust manipulation (TSM) for patients with neck pain, patients in these studies also received cervical manipulation.[2,22,57] The rationale to include thoracic spine mobilization/manipulation in the treatment of patients with neck pain stems from the theory that disturbances in joint mobility in the thoracic spine may be an underlying contributor to musculoskeletal disorders in the neck.[94,105]

I Cleland et al[34] compared the effectiveness of TSM in a trial in which patients were randomized to either a single session of TSM or sham manipulation. Patients who received TSM experienced a clinically meaningful and statistically significant reduction in pain on the visual analogue scale (VAS) compared to patients who received the sham intervention ($P<.001$).[34] A similar finding (reduction of pain) was also reported in a randomized trial that compared TSM intervention to an active exercise program.[147] A subsequent randomized trial by Cleland et al[38] which compared TSM to non-thrust manipulation (mobilization) found significant differences in favor of the TSM group in pain, disability, and patient perceived improvement upon re-evaluation 48 hours later.

II While preliminary reports indicate that patients with complaints of primary neck pain experience a significant benefit when treated with TSM, it is still unclear which patients benefit most. Cleland et al[33] reported a preliminary clinical prediction rule for patients with primary neck pain who experience short-term improvement (1-week) with TSM. Each subject received a total of 3 thoracic manipulations directed at the upper and middle thoracic spine for up to 2 sessions. Using a global rating of change score $\geqslant 5$ as a reference criterion, 6 variables were reported as predictors of improvement and included[33]:

- Symptom duration of less than 30 days
- No symptoms distal to the shoulder
- Subject reports that looking up does not aggravate symptoms
- Fear-avoidance Beliefs Questionnaire-Physical Activity Scale score less than 12

- Diminished upper thoracic spine kyphosis (T3–T5)
- Cervical extension of less than 30°

Interestingly, the lack of symptom aggravation with looking up was also one of the predictors reported by Tseng et al[166] in the cervical manipulation clinical prediction rule. Validation of both the cervical and TSM clinical rules is required before they can be recommended for widespread clinical use.

I In a randomized clinical trial Fernández de las Peñas et al[59] demonstrated that patients with neck pain related to a whiplash-associated disorder receiving TSM experienced a significantly greater (P<.003) reduction in pain as measured by the visual analogue scale, than those who did not receive the thoracic manipulation. The mean change in pain levels in the group receiving TSM was 54.1 mm (SD 18.8 mm) compared to a mean change of 13.4 mm (SD 8.9 mm) in the group not receiving thoracic manipulation. The length of follow-up was not clearly defined.

IV Self-reported levels of pain and cervical active ROM were assessed before and immediately after TSM in 26 patients with a primary complaint of neck pain. The mean reduction in pain on an 11-point numeric pain rating scale was approximately 2 points (P<.01), which has been shown to indicate that a clinically meaningful improvement has occurred. Significant increases in cervical active ROM were also observed in all directions except extension (P<.001). This study did not include a control group and only consisted of an immediate follow-up, but the immediate improvements in pain and cervical active ROM suggest that TSM may have some merit in patients with neck pain.[61]

IV There have been 4 case series that have incorporated thoracic spine thrust manipulation in the multi-modal management of patients with cervical radiculopathy.[23,39,120,176] In the first case series,[39] 10 of the 11 patients (91%) demonstrated a clinically meaningful improvement in pain and function at the 6-month follow-up after a mean of 7.1 physical therapy visits. In the second case series[176] all patients except for 1 exhibited a significant reduction in disability. In the third case series,[120] full resolution of pain was reported in 8 of 15 (53%) patients, where all 6 of the patients receiving mobilization and manipulation achieved full resolution of pain. In addition, there has been 1 case series[23] that included thoracic spine thrust manipulation in the management of 7 patients with grade I cervical compressive myelopathy. All patients exhibited a reduction in pain and improvement in function at the time of discharge.

C Recommendation: Thoracic spine thrust manipulation can be used for patients with primary complaints of neck pain. Thoracic spine thrust manipulation can also be used for reducing pain and disability in patients with neck and neck-related arm pain.

STRETCHING EXERCISES

I In a randomized controlled trial, Ylinen et al[183] assessed the effectiveness of manual therapy procedures implemented twice a week compared with a stretching regimen performed 5 times a week in those with non-specific neck pain. At the 4 and 12 week follow-up both groups improved but there were no significant differences between the groups related to pain. Neck pain and disability outcome measures, shoulder pain and disability outcome measures, and neck stiffness were reduced significantly more in those receiving manual therapy, but the clinical difference was minimal. The authors concluded that the low-cost of stretching exercises should be included in the initial treatment plan for patients with neck pain.

V The authors of this clinical practice guideline have observed that patients with neck pain often present with impairments of flexibility of key muscles related to the lower cervical and upper thoracic spine, such as the anterior, medial, and posterior scalenes, upper trapezius, levator scapulae, pectoralis minor, and pectoralis major, that should be addressed with stretching exercises. One study reported that upper quarter muscle flexibility deficits were common in dental hygienists,[95] an occupation that requires frequent repetitive activities involving the shoulders, arms, and hands. Although research generally does not support the effectiveness of interventions that focus on stretching and flexibility, clinical experience suggests that addressing specific impairments of muscle length for an individual patient may be a beneficial addition to a comprehensive treatment program.

C Recommendation: Flexibility exercises can be used for patients with neck symptoms. Examination and targeted flexibility exercises for the following muscles are suggested: anterior/medial/posterior scalenes, upper trapezius, levator scapulae, pectoralis minor, and pectoralis major.

COORDINATION, STRENGTHENING, AND ENDURANCE EXERCISES

I Jull et al[99] conducted a multi-centered, randomized clinical trial (n=200) in participants who met the diagnostic criteria for cervicogenic headache. The inclusion criteria were unilateral or unilateral dominant side-consistent headache associated with neck pain and aggravated by neck postures or movement, joint tenderness in at least 1 of the upper 3 cervical joints as detected by manual palpation, and a headache frequency of at least 1 per week over a period of 2 months to 10 years. Subjects were randomized into 4 groups: mobilization/manipulation group, exercise therapy group, combined mobilization/manipulation and exercise group, and a control group. The primary outcome was a change in headache frequency. At the 12-month follow-up, the mobilization/manipulation, combined mobilization/manipulation and exercise, and the specific exercise groups had significantly reduced headache frequency and intensity. Additionally 10% more patients experienced a complete reduction in headache frequency when treated with mobilization/manipulation and exercise than those treated with the alternative approaches.[99]

The exercise program in this clinical trial by Jull et al[99] used low load endurance exercises to train muscle control of the cervicoscapular region. The first stage consisted of specific craniocervical flexion exercises, performed in supine lying, aimed to target the deep neck flexor muscles, which are the longus capitis and longus colli. Subsequently, isometric exercises using a low level of rotatory resistance were used to train the co-contraction of the neck flexors and extensors. The exercise groups had significantly reduced headache frequency and intensity when compared to the controls.

I

Chiu et al[28] assessed the benefits of an exercise program that focused both on motor control training of the deep neck flexors and dynamic strengthening. A total of 145 patients with chronic neck pain were randomized to either an exercise or a non-exercise control group. At week 6, the exercise group had significantly better improvements in disability scores, pain levels, and isometric neck muscle strength. However, significant differences between the 2 groups were found only in pain and patient satisfaction at the 6-month follow-up.

I

In a randomized, clinical trial, Ylinen et al[184] demonstrated the effectiveness of both strengthening exercises and endurance training of the deep neck flexor muscles in reducing pain and disability at the 1-year follow-up in women (n = 180) with chronic, nonspecific neck pain. The endurance training group performed dynamic neck exercises, which included lifting the head up from the supine and prone positions. The strength training group performed high-intensity isometric neck strengthening and stabilization exercises with an elastic band. Both training groups performed dynamic exercises for the shoulders and upper extremities with dumbbells. Both groups were advised to also do aerobic and stretching exercises 3 times a week. In a 3-year follow-up study, Ylinen et al[182] found that women (n = 118) in both the strengthening exercise and endurance training groups achieved long-term benefits from the 12-month programs.

III

O'Leary et al[127] compared the effect of 2 specific cervical flexor muscle exercise protocols on immediate pain relief in the cervical spine of people with chronic neck pain. They found that those performing the specific craniocervical flexion exercise demonstrated greater improvements in pressure pain thresholds, mechanical hyperalgesia, and perceived pain relief during active movement.

III

In a cross-sectional comparative study, Chiu et al[29] compared the performance of the deep cervical flexor muscles on the craniocervical flexion test in individuals with (n = 20) and without (n = 20) chronic neck pain. Those with chronic neck pain had significantly poorer performance on the craniocervical flexion test (median pressure achieved, 24 mmHg when starting at 20 mmHg) when compared with those in the asymptomatic group (median pressure achieved, 28 mmHg when starting at 20 mmHg).

I

Jull et al[97] compared the effects of conventional proprioceptive training and craniocervical flexion training on cervical joint position error in people with persistent neck pain. The aim was to evaluate whether proprioceptive training was superior in improving proprioceptive acuity compared to a form of exercise that has been shown to be effective in reducing neck pain. Sixty-four female subjects with persistent neck pain and deficits in cervical joint position error were randomized into 2 exercise groups: proprioceptive training or craniocervical flexion training. Exercise regimens were conducted over a 6-week period. The results demonstrated that both proprioceptive training and craniocervical flexion training have a demonstrable benefit on impaired cervical joint position error in people with neck pain, with marginally more benefit gained from proprioceptive training. The results suggest that improved proprioceptive acuity following intervention with either exercise protocol may occur through an improved quality of cervical afferent input or by addressing input through direct training of relocation sense.[97]

I

In a randomized, clinical trial, Taimela et al[162] compared the efficacy of a multimodal treatment emphasizing proprioceptive training in patients with non-specific chronic neck pain (n = 76). The proprioceptive treatment, which consisted of exercises, relaxation, and behavioral support was more efficacious than comparison interventions that consisted of (1) attending a lecture on the neck and 2 sessions of practical training for a home exercise program, and (2) a lecture regarding care of the neck with a recommendation to exercise. Specifically, the proprioceptive treatment group had greater reductions in neck symptoms, improvements in general health, and improvements in the ability to work.

I

In a randomized clinical trial, Viljanen et al[173] assessed the effectiveness of dynamic muscle training (n= 135), relaxation training (n = 128), or ordinary activity (n = 135) for female office workers with chronic neck pain. Dynamic muscle training and relaxation training did not lead to better improvements in neck pain compared with ordinary activity.

I

In a randomized clinical trial, Bronfort et al[22] found that a combined program of strengthening and endurance exercises combined with manual therapy resulted in greater gains in strength, endurance, range of motion, and long-term patient pain ratings in those with chronic neck pain than programs that only incorporated manual therapy. Additionally, Evans et al[58] found that these results were maintained at a 2-year follow-up.

IV

In a prospective case series, Nelson et al[124] followed patients with cervical and lumbar pain and found that an aggressive strengthening program was able to prevent surgery in 35 of the 60 patients (46 of the 60 completed the program, 38 were available for follow-up, and only 3 reported having surgery). Despite the methodological limitations of this study, some patients that were originally given the option of surgery were able to successfully avoid surgery in the short term following participation in an aggressive strengthening exercise program.

II

In a systematic review of 9 randomized clinical trials and 7 comparative trials with moderate methodological quality for patients with mechanical neck disorders, Sarig-Bahat[145] reported relatively strong evidence supporting the effectiveness of proprioceptive exercises and dynamic resisted strengthening exercises of the neck-shoulder musculature for patients with chronic or frequent neck disorders. The evidence identified could not support the effectiveness of group exercise, neck schools, or single sessions of extension-retraction exercises.

I

In a randomized clinical trial, Chiu et al[30] found in patients with chronic neck pain (n = 218), that a 6-week treatment of transcutaneous electrical nerve stimulation or exercise had a better and clinically relevant improvement in disability, isometric neck muscle strength, and pain compared to a control group. All the improvements in the intervention groups were maintained at the 6-month follow-up.

IV

Hammill et al[74] used a combination of postural education, stretching, and strengthening exercises to reduce the frequency of headaches and improve disability in a series of 20 patients, with results being maintained at a 12-month follow-up.

I

In a systematic review, Kay et al[103] concluded that specific exercises may be effective for the treatment of acute and chronic mechanical neck pain, with or without headache.

I

A recent Cochrane review[69] concluded that mobilization and/or manipulation when used with exercise are beneficial for patients with persistent mechanical neck disorders with or without headache. However, manual therapy without exercise or exercise alone were not superior to one another.

V

Although evidence is generally lacking, postural correction and body mechanics education and training may also be indicated if clinicians identify ergonomic inefficiencies during either the examination or treatment of patients with motor control, movement coordination, muscle power, or endurance impairments.

A

Recommendation: Clinicians should consider the use of coordination, strengthening, and endurance exercises to reduce neck pain and headache.

CENTRALIZATION PROCEDURES AND EXERCISES

I

Kjellman and colleagues[104] randomly assigned 77 patients with neck pain (29 of which presented with cervical radiculopathy) to general exercise, McKenzie method of examination and treatment, or a control group (low intensity ultrasound and education). The McKenzie method of treatment consists of patient positioning, specific repeated movements, manual procedures, and patient education in self management in case of recurrence.[104,118] The repeated specific movements with the McKenzie method intend to centralize (promote the migration of symptoms from an area more distal to location more proximal) or reduce pain.[118] At the 12 month follow-up all groups showed significant reductions in pain intensity and disability but no significant difference between groups existed. Seventy-nine percent of patients reported that they were better or completely restored after treatment, although 51% reported constant/daily pain. All 3 groups had similar recurrence rates.

III

Murphy et al[122] incorporated McKenzie procedures to promote centralization in the management of a cohort of 31 patients with cervical radiculopathy. These patients also received cervical manipulation or muscle energy techniques and neural mobilization. Seventy-seven percent of patients at the short-term follow-up and 93% of patients at the long-term follow-up exhibited a clinically important improvement in disability. However, specific details regarding the number of patients receiving procedures to promote centralization was not reported.

There has not been a clinical trial that recruited patients with only cervical radiculopathy. Therefore, it is not possible to comment on the efficacy of the McKenzie method or the use of centralization procedures and exercises for this particular subgroup of patients.[31]

C Recommendation: Specific repeated movements or procedures to promote centralization are not more beneficial in reducing disability when compared to other forms of interventions.

UPPER QUARTER AND NERVE MOBILIZATION PROCEDURES

II Allison et al[2] examined the effectiveness of 2 different manual therapy techniques (neural mobilization and cervical/upper quadrant mobilization) in the management of cervico-brachial syndrome. All patients received treatment for 8 weeks in addition to a home exercise program. The results demonstrated that both manual therapy groups exhibited improvements in pain and function. At the final data collection there existed no difference between the manual therapy groups for function but a significant difference between groups for reduction in pain was identified in favor of the neural mobilization group.

II In a randomized clinical trial, Coppieters et al[41] assigned 20 patients with cervico-brachial pain to receive either cervical mobilization with the upper extremity in an upper limb neurodynamic position or therapeutic ultrasound. The group receiving the mobilizations exhibited significantly greater improvements in elbow range of motion during neurodynamic testing as well as greater reductions in pain compared to the ultrasound group.

III Murphy et al[122] incorporated neural mobilization in the management of a cohort of patients with cervical radiculopathy. Seventy seven percent of patients at the short-term follow-up and 93% of patients at the long term follow-up exhibited a clinically important decrease in disability. However, no specifics were provided relative to which patients received neural mobilization procedures.

IV Cleland et al[39] described the outcomes of a consecutive series of patients presenting to physical therapy who received cervical mobilization (cervical lateral glides) with the upper extremity in a neurodynamic position as well as thoracic spine manipulation, cervical traction, and strengthening exercises. Ten of the 11 patients (91%) demonstrated a clinically meaningful improvement in pain and function following a mean of 7.1 physical therapy visits.

B Recommendation: Clinicians should consider the use of upper quarter and nerve mobilization procedures to reduce pain and disability in patients with neck and arm pain.

TRACTION

I A systematic review by Graham and colleagues[67] reported that there is moderate evidence to support the use of mechanical intermittent cervical traction.

II Taghi Joghataei et al[93] randomly assigned 30 patients to receive a treatment program consisting of ultrasound and exercise with or without mechanical intermittent cervical traction for 10 sessions. The group receiving traction exhibited greater improvements in grip strength, the primary outcome measure, after 5 sessions. However, no statistically significant difference between groups existed at the time of discharge from physical therapy.[93]

III Saal et al[143] investigated the outcomes of 26 consecutive patients who fit the diagnostic criteria for herniated cervical disc with radiculopathy who received a rehabilitation program consisting of cervical traction and exercise. Twenty-four patients avoided surgical intervention and 20 exhibited good or excellent outcomes.

II In a prospective cohort design Cleland et al[36] identified predictor variables of short-term success for patients presenting to physical therapy with cervical radiculopathy. One of the predictor variables for patients who exhibited a short-term success included a multimodal physical therapy approach consisting of manual or mechanical traction, manual therapy (cervical or thoracic mobilization/manipulation), and deep neck flexor strengthening. The pretest probability for the likelihood of short-term success was 53%. The mean duration of mechanical traction used on patients in this study was 17.8 minutes with an average force of pull of 11 kg (24.3 pounds). The positive likelihood ratio for patients receiving the multimodal treatment approach (excluding other predictor variables) was 2.2, resulting in a post-test probability of success of 71%.[36]

II Raney et al[137] recently developed a clinical prediction rule to identify patients with neck pain likely to benefit from cervical mechanical traction. Sixty-eight patients (38 female) were included in data analysis of which 30 had a successful outcome. All patients received 6 sessions of mechanical intermittent cervical traction starting with a force of pull between 4.5-5.4 kg (10-12 pounds) for a duration of 15 minutes. The force of pull progressively increased based on centralization of symptoms at each subsequent session. A clinical prediction rule with 5 variables was identified:

- Patient reported peripheralization with lower cervical spine (C4-7) mobility testing
- Positive shoulder abduction sign
- Age ≥55 years
- Positive upper limb tension test (median nerve bias utilizing shoulder abduction to 90°)
- Relief of symptoms with manual distraction test

Having at least 3 out of 5 variables present resulted in a positive likelihood ratio equal to 4.81 (95% CI = 2.17-11.4), increasing the likelihood of success with cervical traction from 44% to 79.2%. If at least 4 out of 5 variables were present, the positive likelihood ratio was equal to 11.7 (95% CI = 2.09-69.58), increasing the post-test probability of having improvement with cervical traction to 90.2%.

IV

Three separate case series[39,120,176] describe the management of patients with cervical radiculopathy, where the interventions included traction. In these case series, the patients were treated with a multimodal treatment approach and the vast majority of patients exhibited improved outcomes. In the first report, Cleland et al[39] described the outcomes of a consecutive series of 11 patients presenting to physical therapy with cervical radiculopathy and managed with the use of manual physical therapy, cervical traction, and strengthening exercises. At 6 month follow-up, 91% demonstrated a clinically meaningful improvement in pain and function following a mean of 7.1 physical therapy visits. Similarly, Waldrop[176] treated 6 patients with cervical radiculopathy with mechanical intermittent cervical traction, thoracic thrust joint manipulation, and range of motion and strengthening exercises for the cervical spine. Upon discharge (mean treatment 10 visits, range 5-18 visits; duration 33 days, range 19-56 days), there was a reduction in disability between 13% and 88%. In the third case series, Moeti and Marchetti[120] investigated the outcomes associated with cervical traction, neck retraction exercises, scapular muscle strengthening, and mobilization/manipulation techniques (used for some patients) for 15 patients with cervical radiculopathy. These authors reported full resolution of pain in 53% of patients at the time of discharge.

IV

Browder and colleagues[23] investigated the effectiveness of a multimodal treatment approach in the management of 7 female patients with grade I cervical compressive myelopathy. Patients were treated with intermittent mechanical cervical traction and thoracic manipulation for a median of 9 sessions over a median of 56 days. The median decrease in pain scores was 5 from a baseline of 6 (using a 0-10 pain scale), and median improvement in Functional Rating Index scores was 26% from a baseline of 44%.

B

Recommendation: Clinicians should consider the use of mechanical intermittent cervical traction, combined with other interventions such as manual therapy and strengthening exercises, for reducing pain and disability in patients with neck and neck-related arm pain.

PATIENT EDUCATION AND COUNSELING

I

There is a paucity of high quality evidence surrounding efficacy of treatments for whiplash-associated disorder (WAD). However, existing research supports instructing patients in active interventions, such as exercises, and early return to regular activities as a means of pain control. Rosenfeld et al[142] compared the long-term efficacy of active intervention with that of standard intervention and the effect of early versus delayed initiation of intervention. Patients were randomized to an intervention using frequent active cervical rotation range of motion exercises complemented by assessment and treatment according to McKenzie's principles or to an intervention that promoted initial rest, soft collar utilization, and gradual self-mobilization. In patients with WAD, early active intervention was more effective in reducing pain intensity and sick leave, and in retaining/regaining total range of motion than intervention that promoted rest, collar usage, and gradual self-mobilization. Patient education promoting an active approach can be carried out as home exercises and progressive return to activities initiated and supported by appropriately trained health professionals.

I

An often prescribed intervention for acute whiplash injury is the use of a soft cervical collar. Crawford et al[45] prospectively investigated 108 consecutive patients following a soft tissue injury of the neck that resulted from motor vehicle accidents. Each patient was randomized to a group instructed to engage in early mobilization using an exercise regime or to a group that was instructed to utilize a soft cervical collar for 3 weeks followed by the same exercise regime. Patients were assessed clinically at 3, 12, and 52 week intervals from injury. Intervention that utilized a soft collar was found to have no obvious benefit in terms of functional recovery after neck injury and was associated with a prolonged time period off work. Other investigations have reported similar results.[148,170] Interventions that instruct patients to perform exercises early in their recovery from whiplash type injuries have been reported to be more effective in reducing pain intensity and disability following whiplash injury than interventions that instruct patients to use cervical collars.[148,170]

I

Existing research supports active interventions and early return to regular activities but it has largely been unknown as to which type of active intervention would yield the most benefit. Brison et al[21] assessed the efficacy of an educational video in the prevention of persistent WAD symptoms following rear-end motor vehicle collisions. The video provided reassurance, and education about posture, return to regular activities, specific exercises, and pain management. Patients were randomized to receive either an educational video plus usual care or usual care alone. The primary outcome was presence of persistent WAD symptoms at 24 weeks post injury, based on the frequency and severity of neck, shoulder, or upper back pain. The group receiving the instructional video demonstrated a trend toward less severe WAD symptoms suggesting that the 'act as usual' recommendation that is often prescribed as a management strategy for patients with WAD is not sufficient and, in fact, may exacerbate their symptoms if such activities are provocative of pain.[21]

III

A reduction in pain alone is not sufficient to address the neuromuscular control deficits in patients with chronic symptoms,[157] as these deficits require specific rehabilitation techniques.[99] For example, persistent sensory and motor deficits may render the patient at risk for symptom persistence.[155,156] Support for specificity in rehabilitation can be indirectly found from a recent population-based, incidence cohort study evaluating a government policy of funding community and hospital-based fitness training and multidisciplinary rehabilitation for whiplash.[26] No supportive evidence was found for the effectiveness of this general rehabilitation approach. Therefore, only addressing the lack of fitness and conditioning in this patient population may not be the most efficacious approach to treatment.

I

Ferrari et al[60] studied whether an educational intervention using a pamphlet provided to patients in the acute stage of whiplash injury might improve the recovery rate. One hundred twelve consecutive subjects were randomized to 1 of 2 treatment groups: educational intervention or usual care. The education intervention group received an educational pamphlet based on the current evidence, whereas the control group only received usual emergency department care and a standard non-directed discharge information sheet. Both groups underwent follow-up by telephone interview at 2 weeks and 3 months. The primary outcome measure of recovery was the patient's response to the question, "How well do you feel you are recovering from your injuries?" At 3 months post collision, 21.8% in the education intervention group reported complete recovery compared with 21.0% in the control group (absolute risk difference, 0.8%; 95% CI = -14.4% to 16.0%). At 3 months, there were no clinically or statistically significant differences between groups in severity of remaining symptoms, limitations in daily activities, therapy use, medications used, lost time from work, or litigation. This study concluded that an evidence-based educational pamphlet provided to patients at discharge from the emergency department is no more effective than usual care for patients with grade I or II WAD.[60]

I

Jull et al[99] conducted a preliminary randomized controlled trial with 71 participants with persistent neck pain following a motor vehicle accident to explore whether a multimodal program of physical therapies was an appropriate management strategy compared to a self-management approach. Participants were randomly allocated to receive either a multimodal physical therapy program or a self-management program (advice and exercise). Furthermore, participants were stratified according to the presence or absence of widespread mechanical or cold hyperalgesia. The intervention period was 10 weeks and outcomes were assessed immediately following treatment. Even with the presence of sensory hypersensitivity in 72.5% of subjects, both groups reported some relief of neck pain and disability, measured using Neck Disability Index scores, and it was superior in the group receiving multimodal physical therapy (P=.04). However, the overall effects of both programs were mitigated in the group presenting with both widespread mechanical and cold hyperalgesia. Further research aimed at testing the validity of this sub-group observation is warranted.[98]

II

A comprehensive review[117] of the available scientific evidence produced a set of unambiguous patient centered messages that challenge unhelpful beliefs about whiplash, promoting an active approach to recovery. The use of this rigorously developed educational booklet (The Whiplash Book) was capable of improving beliefs about whiplash and its management for patients with whiplash-associated disorders.[117]

IV

In a small case series, Soderlund and Lindberg[153] reported that physical therapy integrated with cognitive behavioral components decreased pain intensity in problematic daily activities in 3 individuals with chronic WAD.

II

Predictors of outcome following whiplash injury have been limited to socio-demographic and factors of symptom location and severity, which are not readily amenable to intervention. However, evidence exists to demonstrate that psychological factors are present soon following injury and play a role in recovery from whiplash injury.[98,155,158] These factors can be as diverse as the physical presentation and can include affective disturbances, anxiety, depression, and fear of movement.[123,132,178] Furthermore, post-traumatic stress disorder[112] has also been observed in both the acute[52] and chronic conditions and has been shown to be prognostic.[171] Identifying these factors in patients may assist in the development of relevant subgroups and appropriately matched education and counseling strategies that practitioners should utilize in management of patients with WAD.

A Recommendation: To improve the recovery in patients with whiplash-associated disorder, clinicians should (1) educate the patient that early return to normal, non-provocative pre-accident activities is important, and (2) provide reassurance to the patient that good prognosis and full recovery commonly occurs.

TABLE 4 Neck Pain Impairment/Function-based Diagnosis, Examination and Intervention Recommended Classification Criteria*

Impairment-Based Category (With ICD-10 Associations)	Symptoms	Impairments of Body Function	Interventions
Neck pain with mobility deficit • Cervicalgia • Pain in thoracic spine	• Unilateral neck pain • Neck motion limitations • Onset of symptoms is often linked to a recent unguarded / awkward movement or position • Associated (referred) upper extremity pain may be present	• Limited cervical range of motion • Neck pain reproduced at end ranges of active and passive motions • Restricted cervical and thoracic segmental mobility • Neck and neck-related upper extremity pain reproduced with provocation of the involved cervical or upper thoracic segments	• Cervical mobilization / manipulation • Thoracic mobilization / manipulation • Stretching exercises • Coordination, strengthening, and endurance exercises
Neck Pain with Headache • Headache • Cervicocranial syndrome	• Noncontinuous, unilateral neck pain and associated (referred) headache • Headache is precipitated or aggravated by neck movements or sustained positions	• Headache reproduced with provocation of the involved upper cervical segments • Limited cervical range of motion • Restricted upper cervical segmental mobility • Strength and endurance deficits of the deep neck flexor muscles	• Cervical mobilization / manipulation • Stretching exercises • Coordination, strengthening, and endurance exercises
Neck Pain with Movement Coordination Impairments • Sprain and strain of cervical spine	• Neck pain and associated (referred) upper extremity pain • Symptoms are often linked to a precipitating trauma/whiplash and may be present for an extended period of time	• Strength, endurance, and coordination deficits of the deep neck flexor muscles • Neck pain with mid-range motion that worsens with end range movements or positions • Neck and neck-related upper extremity pain reproduced with provocation of the involved cervical segment(s) • Cervical instability may be present (note that muscle spasm adjacent to the involved cervical segment(s) may prohibit accurate testing)	• Coordination, strengthening, and endurance exercises • Patient education and counseling • Stretching exercises
Neck Pain with Radiating Pain • Spondylosis with radiculopathy • Cervical disc disorder with radiculopathy	• Neck pain with associated radiating (narrow band of lancinating) pain in the involved upper extremity • Upper extremity paresthesias, numbness, and weakness may be present	• Neck and neck-related radiating pain reproduced with: 1. Cervical extension, sidebending, and rotation toward the involved side (Spurling's test) 2. Upper limb tension testing • Neck and neck-related radiating pain relieved with cervical distraction • May have upper extremity sensory, strength, or reflex deficits associated with the involved nerve(s)	• Upper quarter and nerve mobilization procedures • Traction • Thoracic mobilization / manipulation

* *Recommendation based on expert opinion.*

CLINICAL GUIDELINES

Summary of Recommendations

E PATHOANATOMICAL FEATURES

Although the cause of neck pain may be associated with degenerative processes or pathology identified during diagnostic imaging, the tissue that is causing a patient's neck pain is most often unknown. Thus, clinicians should assess for impaired function of muscle, connective, and nerve tissues associated with the identified pathological tissues when a patient presents with neck pain.

B RISK FACTORS

Clinicians should consider age greater than 40, coexisting low back pain, a long history of neck pain, cycling as a regular activity, loss of strength in the hands, worrisome attitude, poor quality of life, and less vitality as predisposing factors for the development of chronic neck pain.

B DIAGNOSIS/CLASSIFICATION

Neck pain, without symptoms or signs of serious medical or psychological conditions, associated with (1) motion limitations in the cervical and upper thoracic regions, (2) headaches, and (3) referred or radiating pain into an upper extremity are useful clinical findings for classifying a patient into one of the following International Statistical Classification of Diseases and Related Health Problems (ICD) categories: cervicalgia, pain in thoracic spine, headaches, cervicocranial syndrome, sprain and strain of cervical spine, spondylosis with radiculopathy, and cervical disc disorder with radiculopathy; and the associated International Classification of Functioning, Disability, and Health (ICF) impairment-based category neck pain with the following impairments of body function:

Neck pain with mobility impairments (b7101 Mobility of several joints)
Neck pain with headaches (28010 Pain in head and neck)
Neck pain with movement coordination impairments (b7601 Control of complex voluntary movements)
Neck pain with radiating pain (b2804 Radiating pain in a segment or region)

The following physical examination measures may be useful in classifying a patient in the ICF impairment-based category of neck pain with mobility impairments and the associated ICD categories of cervicalgia or pain in thoracic spine.

- Cervical active range of motion
- Cervical and thoracic segmental mobility

The following physical examination measures may be useful in classifying a patient in the ICF impairment-based category of neck pain with headaches and the associated ICD categories of headaches or cervicocranial syndrome.

- Cervical active range of motion
- Cervical segmental mobility
- Cranial cervical flexion test

The following physical examination measures may be useful in classifying a patient in the ICF impairment-based category of neck pain with movement coordination impairments and the associated ICD category of sprain and strain of cervical spine.

- Cranial cervical flexion test
- Deep neck flexor endurance

The following physical examination measures may be useful in classifying a patient in the ICF impairment-based category of neck pain with radiating pain and the associated ICD categories of spondylosis with radiculopathy or cervical disc disorder with radiculopathy.

- Upper limb tension test
- Spurling's test
- Distraction test

B DIFFERENTIAL DIAGNOSIS

Clinicians should consider diagnostic classifications associated with serious pathological conditions or psychosocial factors when the patient's reported activity limitations or impairments of body function and structure are not consistent with those presented in the diagnosis/classification section of this guideline, or, when the patient's symptoms are not resolving with interventions aimed at normalization of the patient's impairments of body function.

A EXAMINATION – OUTCOME MEASURES

Clinicians should use validated self-report questionnaires, such as the Neck Disability Index and the Patient-Specific Functional Scale for patients with neck pain. These tools are useful for identifying a patient's baseline status relative to pain, function, and disability and for monitoring a change in patient's status throughout the course of treatment.

F EXAMINATION – ACTIVITY LIMITATION MEASURES

Clinicians should utilize easily reproducible activity limitation and participation restriction measures associated with their patient's neck pain to assess the changes in the patient's level of function over the episode of care.

A INTERVENTIONS – CERVICAL MOBILIZATION/MANIPULATION

Clinicians should consider utilizing cervical manipulation and mobilization procedures, thrust and non-thrust, to reduce neck pain and headache. Combining cervical manipulation and mobilization with exercise is more effective for reducing neck pain, headache, and disability than manipulation and mobilization alone.

C INTERVENTIONS – THORACIC MOBILIZATION/MANIPULATION

Thoracic spine thrust manipulation can be used for patients with primary complaints of neck pain. Thoracic spine thrust manipulation can also be used for reducing pain and disability in patients with neck and neck-related arm pain.

Summary of Recommendations *(continued)*

C INTERVENTIONS – STRETCHING EXERCISES

Flexibility exercises can be used for patients with neck symptoms. Examination and targeted flexibility exercises for the following muscles are suggested by the authors: anterior/medial/posterior scalenes, upper trapezius, levator scapulae, pectoralis minor, and pectoralis major.

A INTERVENTIONS – COORDINATION, STRENGTHENING, AND ENDURANCE EXERCISES

Clinicians should consider the use of coordination, strengthening, and endurance exercises to reduce neck pain and headache.

C INTERVENTIONS – CENTRALIZATION PROCEDURES AND EXERCISES

Specific repeated movements or procedures to promote centralization are not more beneficial in reducing disability when compared to other forms of interventions.

B INTERVENTIONS – UPPER QUARTER AND NERVE MOBILIZATION PROCEDURES

Clinicians should consider the use of upper quarter and nerve mobilization procedures to reduce pain and disability in patients with neck and arm pain.

B INTERVENTIONS – TRACTION

Clinicians should consider the use of mechanical intermittent cervical traction, combined with other interventions such as manual therapy and strengthening exercises, for reducing pain and disability in patients with neck and neck-related arm pain.

A INTERVENTIONS – PATIENT EDUCATION AND COUNSELING

To improve the recovery in patients with whiplash-associated disorder, clinicians should (1) educate the patient that early return to normal, non-provocative pre-accident activities is important, and (2) provide reassurance to the patient that good prognosis and full recovery commonly occurs.

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ERRATA

CORRECTIONS

In the September 2008 issue of *Journal of Orthopaedic & Sports Physical Therapy*, we make the following corrections to the "Neck Pain: Clinical Practice Guidelines":

- Under "Primary ICF Codes" on page A6, the ICF code for "Pain in head and neck," printed as "28010," should be b28010.
- Under Secondary ICF Codes on pages A7 and A8, the ICF code for "Driving motorized vehicles," printed in 4 instances as "d4750," should be d4751.
- Under Secondary ICF Codes on pages A7 and A8, the ICF code for "Driving animal-powered transportation," printed in 4 instances as "d4750," should be d4752.
- Under Secondary ICF codes on pages A7 and A8, the ICF Code for "Maintaining a standing position," printed in 2 instances as "d4150," should be d4154.

Please accept our apology for these errors. Corrected reprints of the Guidelines are available for download on the *JOSPT* web site (www.jospt.org).